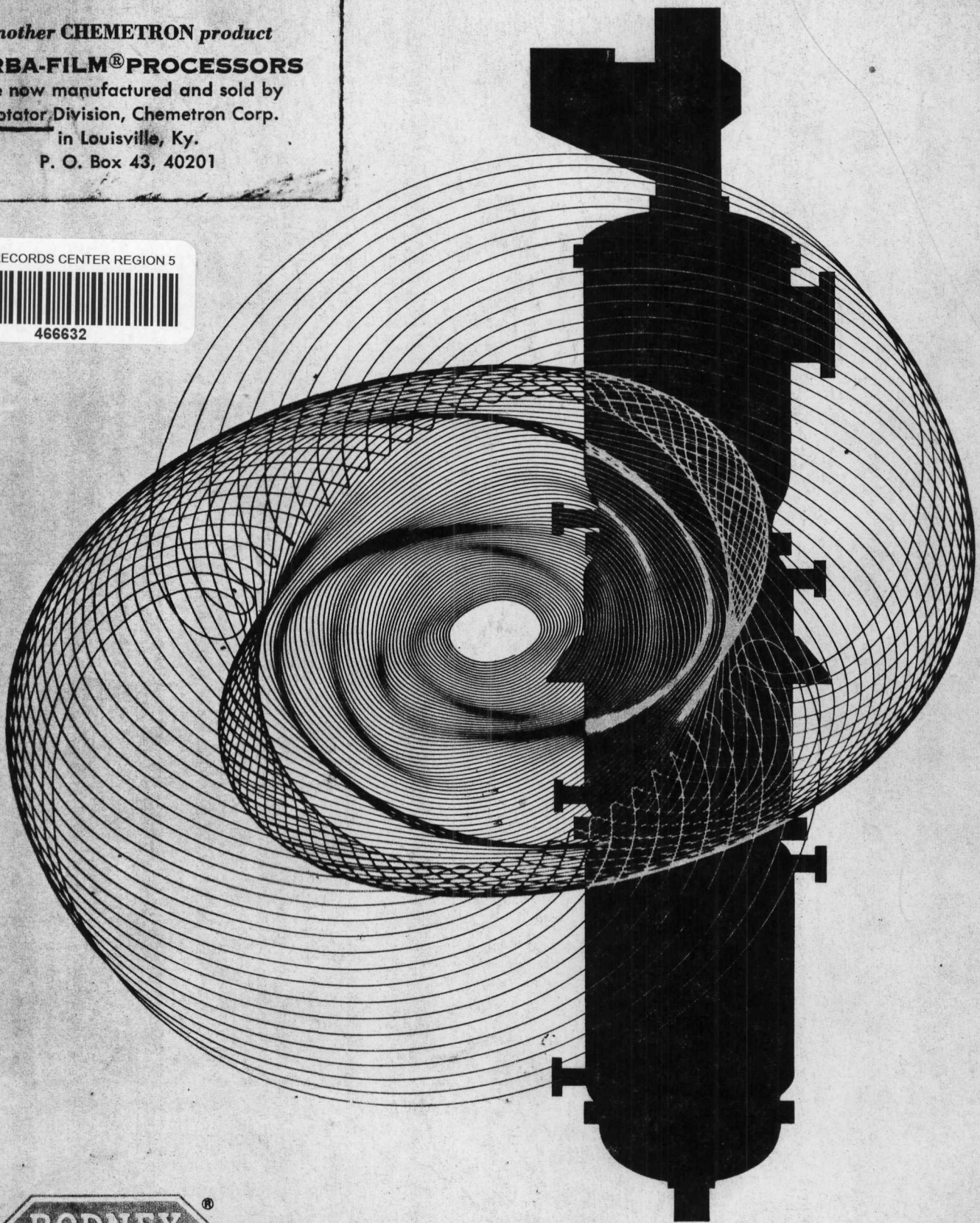
another **CHEMETRON** *product*

TURBA-FILM® PROCESSORS
are now manufactured and sold by
Votator Division, Chemetron Corp.
in Louisville, Ky.
P. O. Box 43, 40201



RODNEY HUNT®

PROCESS-MATCHED
TURBA-FILM PROCESSOR

Continuous Thermal Processing with the Rodney Hunt Process-Matched

TURBA-FILM® PROCESSOR

In 1951, Rodney Hunt first introduced a mechanically-aided, thin-film processor in the United States. This original design made possible, for the first time, continuous processing of many fluids, which are time-at-temperature sensitive and/or viscous, without degradation under precisely controlled conditions.

Since that time, a number of significant design modifications and improvements have greatly broadened the application of the Turba-Film Processor to a large number of products with widely different characteristics. Today, more than 375 of these units are successfully processing organic and inorganic chemicals, pharmaceuticals, foods and many other products.

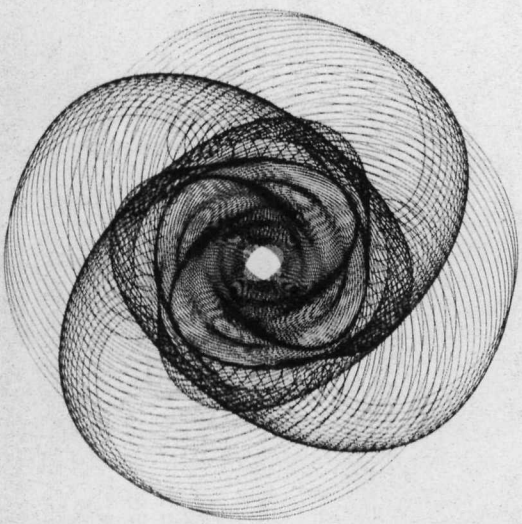
These processes involve concentration, evaporation, distillation, desolventization, deodorization, stripping and reaction. Utilizing mechanical agitation of the falling film on the thermal walls, high heat transfer rates are achieved even with highly viscous materials. Processing is completed rapidly in one pass with relatively small quantities of product being processed at any given instant. This relatively low retention time is an important reason why the Turba-Film Processor is so widely used for heat sensitive materials.

Based on the application experience of well over 12 years, along with extensive research and product testing, Rodney Hunt has perfected significant design innovations which allow for the greatest possible flexibility in matching the Turba-Film Processor to specific process requirements of a broader range of products than ever before. Important operating advantages include:

- higher boil-down ratio where requirements call for a high overhead percentage
- maximum removal of volatiles in one pass
- lower bottoms discharge rates at any boil-down ratio
- higher heat transfer coefficients at high boil-down ratios
- improved treatment of ultra high viscosity products
- increased permissible temperature difference without product degradation
- reduced space requirements

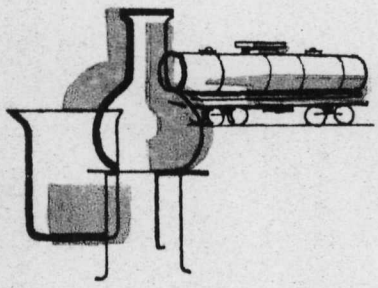
Together, these features bring about a reduction of processing costs and increase profits while contributing to improved product quality and process efficiency.

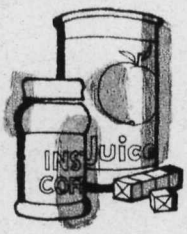
RODNEY HUNT®



AREAS OF USE

In Evaporation • Concentration • Dehydration • Distillation
Desolventization • Deodorization • Stripping • Reaction





CHEMICALS

Acid chlorides Alkali metal sulfonates Bisphenol
Caprolactam Chlorinated hydrocarbons
Chlorohydrins Cumene Hydroperoxide
Diallyl phthalate Di-isocyanates
Epoxy resins Ethanolamines Formic acid
Glycerine Glycols Latices Melamine resins
Organic distillates Phenol Plastics
Polymers Polyvinyl alcohol Sodium petronate
Stearic acid Urea Urea formaldehyde resins

PHARMACEUTICALS

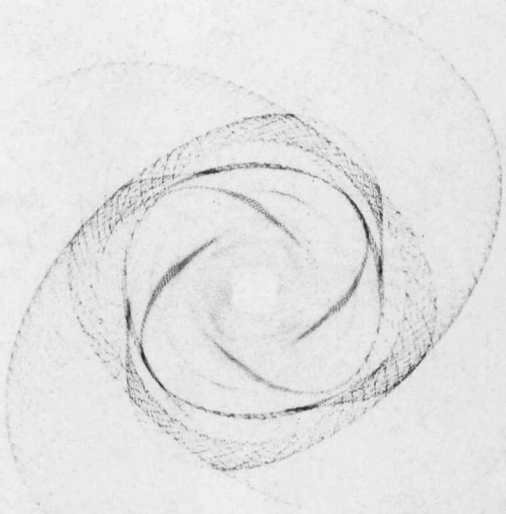
Ascorbic acid Biologicals Enzymes
Fermentation products Hormone solutions
Organic extracts Penicillin Sera Sorbose
Steroids Virus extracts Vitamins

FOOD

Candy syrups Caramel Citrus products
Coffee Corn syrup Dextrose Fruit juices
Fruit purees Gelatin Honey Lecithin
Malt extract Meat extracts Milk Molasses
Pectin Soup stocks Tea Tomato paste
Whey Yeast

OTHER PRODUCTS

Coal tar products Detergents Dyestuffs Glue
Gum arabic Gum karaya Insulating oils
Radioactive waste Rubber accelerators
Tobacco extracts Vegetable oils
Viscose Waxes



RODNEY HUNT

THIN-FILM PROCESSING

with mechanically aided heat and mass transfer

HOW THE TURBA-FILM PROCESSOR OPERATES

The material to be processed enters the feed section above the thermal wall and is distributed in a thin uniform film by the centrifugal action of the rotor blades. Turbulence is imparted to the film as it spirals downward inducing a high rate of heat transfer into the film and in the formation of vapor. The concentrated material exits through the bottom discharge section while vapors rise upward through the separating section and out the vapor opening.

Processing is completed in one pass with no recirculation. The action of the rotor blades keeps the thin film in continuous turbulent motion preventing localized overheating. Since there is no "liquid level," elevation in boiling point due to hydrostatic head is eliminated. Only a small amount of material is in process at any one time resulting in an extremely short hold-up time. These features make the Turba-Film Processor ideally suited to handling time-at-temperature-sensitive substances as well as highly viscous or foamy materials.

Many other advantages can be realized including—flexibility of use for changeover from one product to another—minimized cleaning—accurate quality control—and less floor space required.

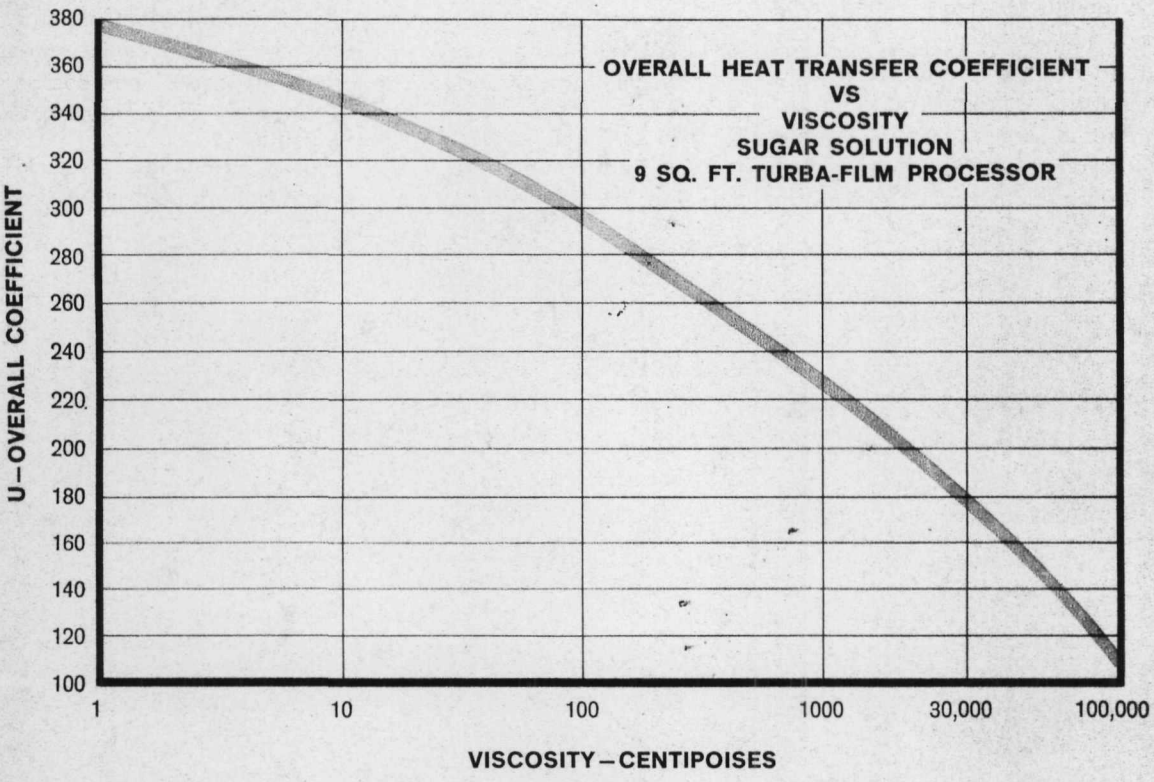
DESIGN PARAMETERS

The design of a Turba-Film Processor encompasses many variables such as—feed rate, feed temperature, delta T, rotor speed, blade clearance, wall thickness, length-diameter ratio and product viscosity with all the other physical properties of a particular substance. These variables are interrelated and affect one another in the performance of the Processor. The following discussion will provide a better understanding of their effect on heat and mass transfer and upon retention time within a Turba-Film Processor.

Viscosity—Newtonian liquids having a high resistance to shear are subjected to a high shear stress by the action of the rotor blades. The turbulence thus created can be defined by the familiar Reynolds Number by substitution of the appropriate values. Turba-Film Processors generally operate in the region of turbulent flow which characterizes the high heat transfer rates obtainable. The curve opposite is typical for a Newtonian type sugar syrup.

Thixo-tropic or other pseudoplastic-type substances generally have high apparent viscosities and poor flow characteristics. However, when a high operating shear rate is imposed on these materials by the rotor, their viscosity decreases considerably, often by a factor of 100. Thus the agitation provided by the Turba-Film Processor facilitates heat transfer even with materials having a viscosity of 100,000 centipoises or more.

Rotor Speed—In general, increasing the rotor speed raises the rate of heat transfer for most materials. However, a point is reached where the gain in overall coefficient does not justify the added power input. Therefore, a "practical" value is selected and this is dependent upon the viscosity and the through-put rate. Turba-Film Processors generally operate with a blade tip speed not exceeding 50 feet per second.



Wall Thickness—The wall thickness of the thermal section is an important factor in the overall heat transfer rate since it generally comprises ⅓ to ½ of the total resistance to the flow of heat. The recognition of this fact is important when scaling up from small size to large size units which have thicker walls and therefore a higher percentage of the total resistance. One criteria in scale up is the permissible heat flux (U x Delta T) which provides a skin temperature compatible to the product.

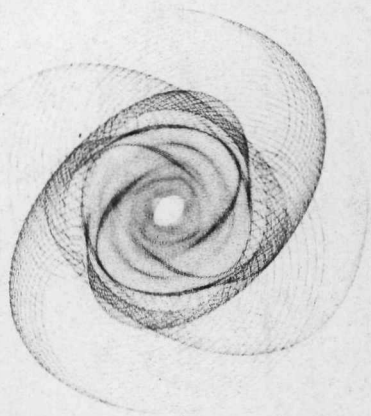
RETENTION TIME

A heat-sensitive material is often defined as one having a maximum stable temperature. However, all too often ignored is the fact that there is a time limit for exposure to any temperature after which product characteristics could suffer. To illustrate further, a particular substance may not suffer any injurious effects when heated for 10 minutes at 100° F or for 3 minutes at 150° F. Recent studies have indicated that in many cases the time factor is of more significance than the temperature, thereby suggesting the increased use of short contact time evaporators operating at higher permissible temperatures.

This feature of short contact time is inherent in a Turba-Film Processor since the only material in process is that which is held to the heating surface in the form of a turbulent film. Therefore the contact time is extremely short and processing is completed in a matter of seconds on low to medium viscosity materials. In contrast, recirculating-type tubular evaporators may require several hours for discharging the bulk of material in process. Inherently, this is due to not only the large holding volume, but also adherence to the law of probability which suggests that some portion of the material will stay within the evaporator for as long as it operates. With no recirculation present in the Turba-Film Processor, the actual retention time follows closely to the calculated value.

Retention time within the Turba-Film Processor is a variable depending upon feed rate, viscosity, and blade clearance. Neither one of these variables is an independent controlling factor since a change in one can affect the other. In general, the total process retention time is 1.5 to 3.5 minutes for materials having a viscosity of 100 cp to 1000 cp.

It becomes apparent, therefore, that mechanically aided thin-film processing particularly lends itself to the handling of heat sensitive and/or viscous materials for maximum retention of flavor, color, biological activity, product stability or other desirable characteristics.



TYPICAL FLOW SHEETS

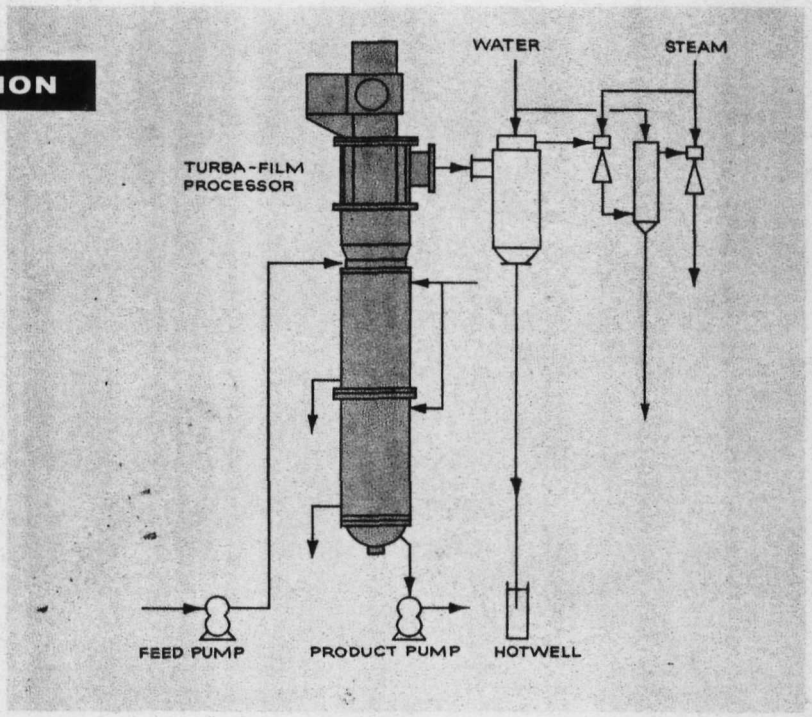
illustrating **TURBA-FILM PROCESSOR** *versatility*

CONCENTRATION

Evaporation to a high percent solids furnishes one of the widest applications for the Turba-Film Processor. As solids content increases, temperature sensitivity and viscosity generally increase and a need for short contact time is required. The Turba-Film Processor satisfies this requirement by being able to induce high heat transfer to highly viscous products while discharging the concentrated product in a matter of seconds. Examples of such concentration of feed material to end product in % solids are:

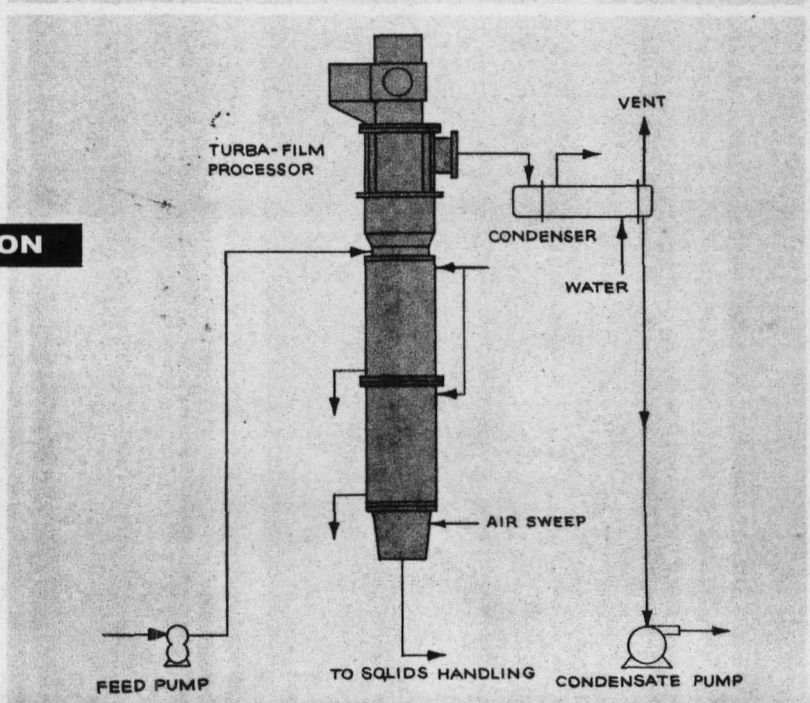
apricot puree — feed from 12% to 24% end product
coffee — feed from 20% to 40% end product
gelatin — feed from 17% to 35% end product
gum karaya — feed from 9% to 23% end product
latex — feed from 40% to 60% end product
sorbitol — feed from 70% to 99% end product
tobacco extract — feed from 10% to 48% end product
tomato paste — feed from 20% to 40% end product.

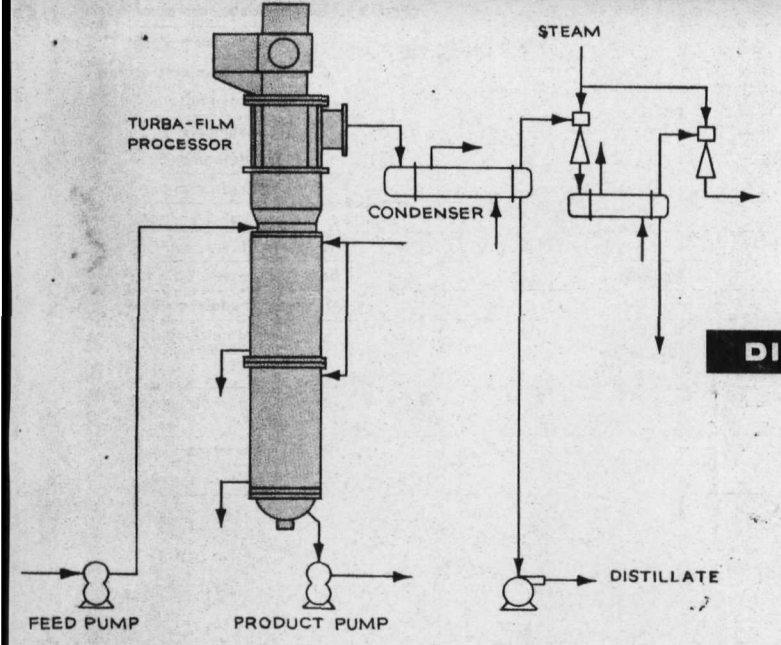
It should be noted that many of these products can be concentrated to a much higher percent solids depending upon process requirements.



REACTION & DEHYDRATION

Certain organic and inorganic salt solutions lend themselves to complete dehydration where a dry powder can be discharged continuously from a Turba-Film Processor. The flow diagram at the right illustrates an example of reaction, evaporation and dehydration all taking place continuously in one pass under atmospheric pressure for the production of a dry detergent powder. For reactions of other types involving esterification, polymerization, etc., it is often feasible to perform these continuously in a Turba-Film by the addition of features for the control of retention time.

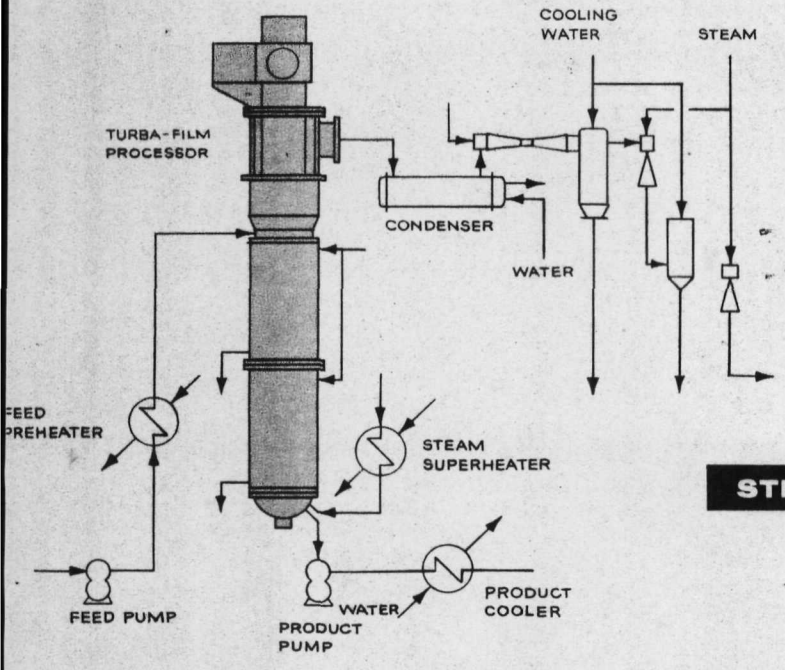




DISTILLATION

The vaporization of organic volatiles from relatively non-volatile substances is an area of wide use for Turba-Film Processors. Counter-current flow of vapor to liquid within the processor, together with cold feed streams, enables the Turba-Film to distill high purity vapor with minimum high boilers. Depending upon product characteristics, three or four plate fractionation may be obtained. When vaporizing an organic volatile from a fluid non-volatile, a discharge with minimum volatile content can be obtained. This is accomplished by high mass transfer in the diffusion of volatiles from a thin film. Steam distillation can also be employed for high boiling point materials that are heat sensitive and in situations where near-complete recovery of volatiles is desired. For deodorization problems, steam distillation is also used. Distillation examples include the following:

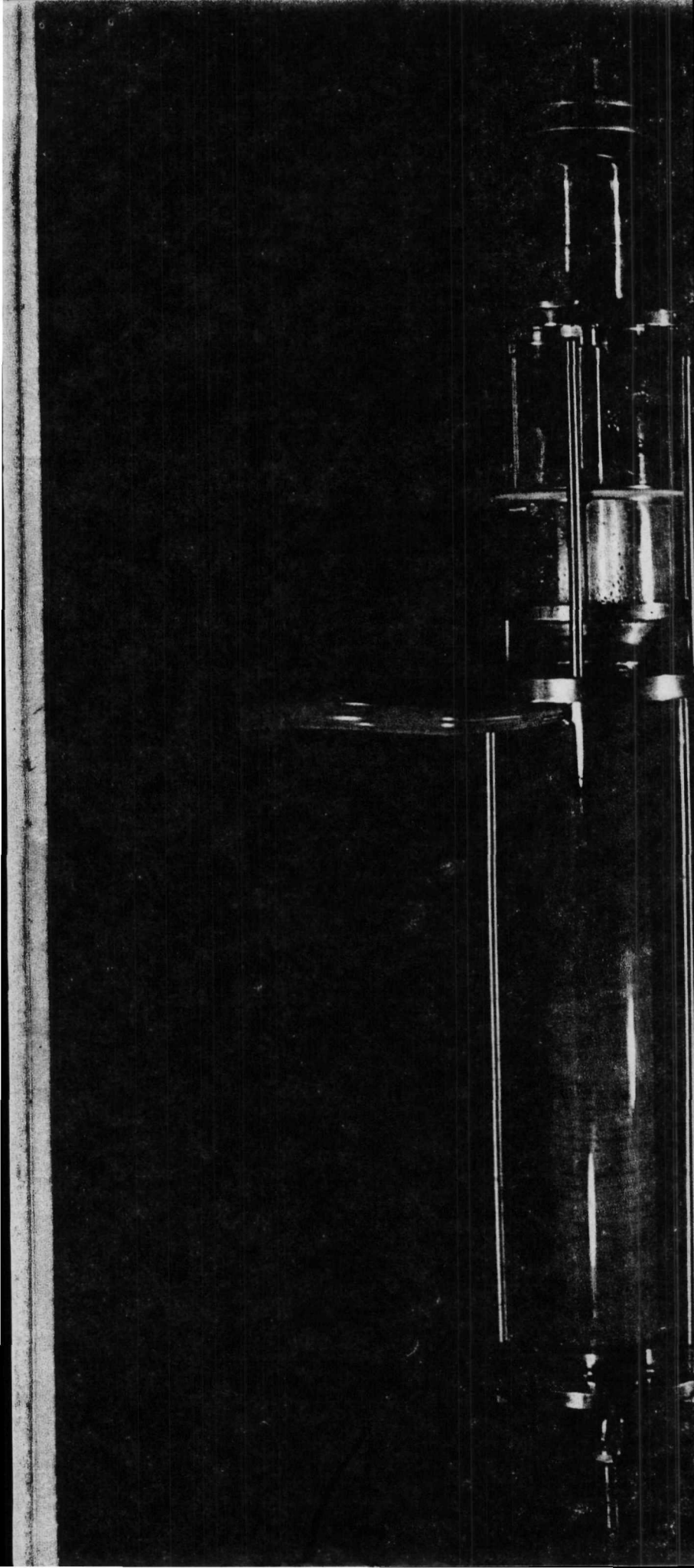
Phenol from tarry residues
Chlorohydrins from epoxy resins
Ethylene glycol from tri-ethylene glycol and residues
Isopropyl alcohol from sodium petronate
Glycerine from monoglycerides
Caprolactam from oligimers



STEAM DISTILLATION

TYPICAL OPERATING CONDITIONS IN TURBA-FILM PROCESSING

	Organic Resin Plasticizers	Synthetic Vitamin Extract	Nylon Salt	Synthetic Resin Adhesive	Synthetic Rubber Latex	Soluble Coffee
Evaporator absolute pressure, mm Hg	1.3	35	5	90	60	86
Heating jacket temperature, °F	424	212	310	212	200	213
Heating medium	Liquid Dowtherm	Steam	Steam	Steam	Vacuum Steam	Steam
Vapor temperature, °F	388	90	250	120	100	119
Residue temperature, °F	—	95	255	122	100	—
Feed temperature, °F	275	62	215	127	97	130
Feed rate, lbs/hr/sq ft	9.2	42	53	155	75	53
Vapor rate, lbs/hr/sq ft	7.1	26	32	40	28	42
Residue rate, lbs/hr/sq ft	2.1	16	21	115	47	—
Blowing steam, % of feed	0	0	0	0	0	—
Rotor peripheral speed, ft/sec	45	45	45	45	27	43.7
Composition of feed	High boiling & coke forming; APHA color 370	16% solids; pH about 3	Distillate of nylon salt	50.6% water; 49.4% sol; vis., 102 cp at 75°F	41% solids	12 to 15% extract
Composition of product	APHA color 10 (distillate)	45% solids	Color meets specification	64% solids; vis., 2200 cp at 76° F	60% solids; no coagulum	65% solids
Heat transferred, 1000 Btu/hr/sq ft	1.48	30	7.7	39.4	29	41
Over-all coefficient (U), Btu/hr/sq ft/°F	43.5	230	146.5	440	290	447



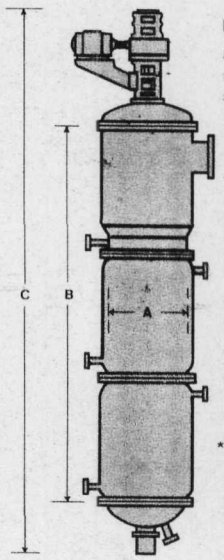
RODNEY HUNT®

PROCESS-MATCHED

The Rodney Hunt Process-Matched Turba-Film Processor offers a number of exclusive design options as to blade system, drives, separator sections, discharge heads, bearings and seals to provide optimum flexibility in matching the Processor to the process or product requirements. This design flexibility substantially increases the efficiency of the unit as a processing tool. Further, it greatly extends the types of materials which can be more economically processed on a continuous basis.

The basic components of the Process-Matched Turba-Film Processor include the thermal section, rotor with blades, drive, discharge head and separator section. These components as described below are identified in the cut-away illustration to the right.

1. The drive unit can be any one of a number of types shown on pages 11 and 12 to provide the required torque and speed for the rotor and blade system.
2. The rotor shaft thrust bearing supports the rotor and blade assembly. This bearing and seal is designed to facilitate cleaning and servicing of the unit.
3. The vapor outlet is designed to permit full exhausting of the vapor from the separator section.
4. The entrainment separator and vapor outlet section may be either of the two designs described on pages 11 and 12. The characteristics of the vapor, degree of product foaming, etc., determine which design is utilized.



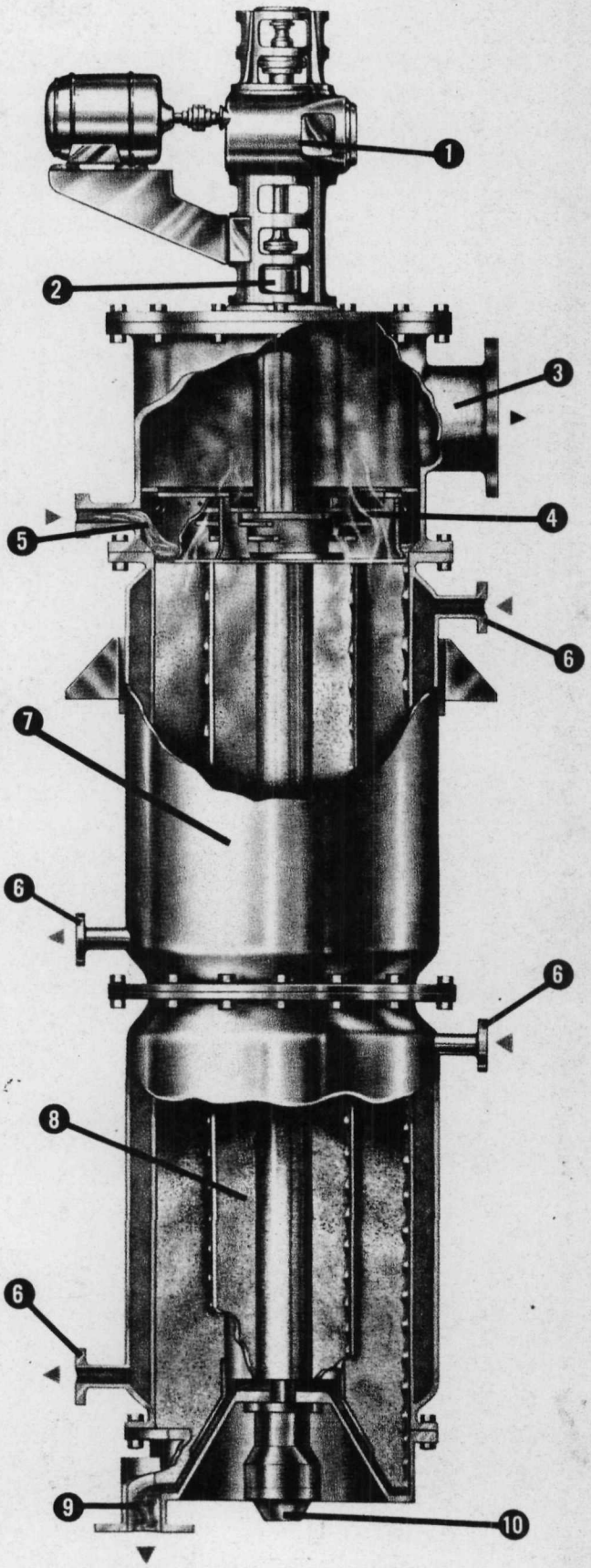
DIMENSIONS

All dimensions are approximate, depending on the specific design requirements of the Processor. More than fifteen other intermediate sizes are available to choose from.

MODEL NUMBER	GROSS AREA (Sq. Ft.)	A	B	C*
06-030	4	6″	4′-1″	6′-4″
12-048	12	12″	5′-11″	8′-5″
18-072	28	18″	9′-4″	12′-3″
18-096	38	18″	11′-4″	14′-3″
24-120	63	24″	13′-4″	17′-1″
30-120	79	30″	15′-0″	19′-0″
30-144	94	30″	17′-0″	21′-0″
36-180	141	36″	20′-0″	27′-6″
42-216	198	42″	23′-0″	31′-4″
48-216	225	48″	23′-0″	32′-0″

*NOTE: Sizes smaller than 18″ diam.—Belt & Sheave drive only.
Sizes 18″ diam. thru 30″ diam.—Add approx. 3 ft. if Inte-Drive furnished.
Sizes 36″ diam. thru 48″ diam.—Inte-Drive only.

TURBA-FILM® PROCESSOR



5. The feed inlet at the top of the thermal section provides for uniform distribution of the feed material over the thermal wall.
6. Heating medium inlets and outlets provide steam, Dowtherm or other media for the compartments of the thermal section. For liquid mediums, spiral baffles are furnished to assure an even temperature around the thermal walls and to induce high heat transfer rates.
7. The thermal section consists of one or more jacketed units. The size of this section is determined by the heat transfer area required by the process design. Standard sizes range from 1 sq. ft. to 225 sq. ft. Special, non-standard sizes can be fabricated to order.
8. Rotor and blades are selected to match the design requirement from among the blade systems described on page 13.
9. Product discharge head can be one of three types as determined by the characteristics of the product as it reaches this point in the Processor. These options are described on pages 11 and 12.
10. The bottom bearing can be external or internal depending on the design requirement and choice of discharge head.

Rodney Hunt Process-Matched Turba-Film Processors are offered in standard diameters to 48 inches and heat transfer surfaces to 225 sq. ft. Materials of construction can be stainless steel, nickel, Hastelloy, Inconel, Monel, or other special alloys, conforming with ASME and API-ASME codes. Size, rotor blades, speed, horsepower, instrumentation, auxiliary equipment and other specifications are matched to the process requirements.

INTERNAL FINISH SPECIFICATIONS

Rodney Hunt #1 Finish – Standard industrial finish equivalent to annealed and pickled or cold rolled finish – welds brushed but not ground. Thermal section walls, however, are polished to an 80 grit finish.

Rodney Hunt #80 – Equivalent to 80 grit with all internal welds ground flush.

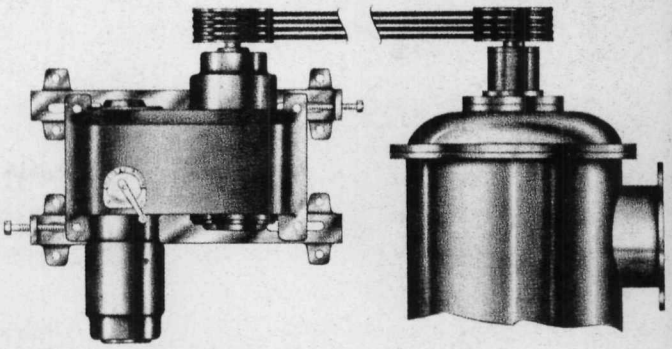
Rodney Hunt #4 – Highly polished sanitary type with internal welds ground flush and polished.

NOTE: All thermal sections for Turba-Film Processors are accurately bored internally to close tolerance resulting in uniform blade clearance to the wall.

FOR DETAILED SPECIFICATIONS –

Write to Rodney Hunt Process Equipment Division outlining your process and product requirement. For your convenience, a data transmittal form is inserted at the back of this catalog. Rodney Hunt's engineering staff welcomes the opportunity to work with your organization in the appropriate application of its equipment to your specific needs. If a test of your product is indicated, Rodney Hunt makes available its laboratory and pilot plant for this purpose. Or you may wish to run your own test in your plant utilizing the portable Turba-Film Processor described on page 14.

OPTIONS



DRIVES

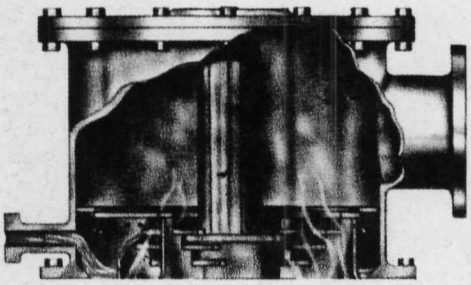
These and other drive arrangements can be furnished to comply with plant requirements or customer preference.

Variable speed—offers flexibility in precise changes of rotor speed.

VAPOR SEPARATORS

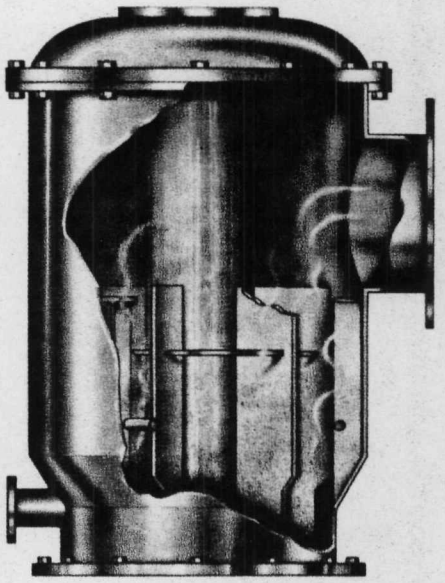
Two designs are offered. **Unit A** passes the vapor in spiralling streams through a stepped series of rotating concentric rings which deflect the vapor radially inward while any entrained droplets are thrown outward and returned to the thermal section. Thus the combination of rotary velocity, centrifugal action, and change of direction results in a very compact separator offering the advantage of lower head room requirement. In addition, its design incorporates a revolving feed distributor ring which spreads the feed material into a thin film at the very upper part of the thermal section thereby utilizing every bit of available heat transfer area. The design is particularly effective handling thin liquids or operating at low rotor speeds.

Unit B has vertical rotating blades which pass any entrained droplets to stationary fins which return them to the thermal section. High centrifugal action coupled with impingement makes this a highly efficient separator suited to products producing a foam.



UNIT A

UNIT B

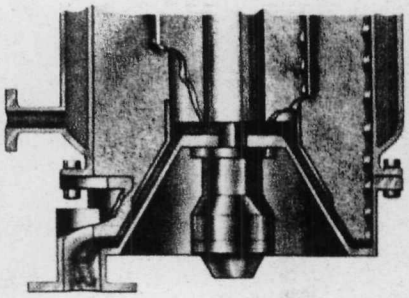


BOTTOM HEADS

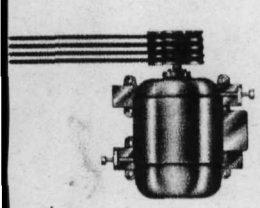
The Inverted Positive Discharge Type of bottom head provides for a continuous propelling action of the rotor blades on the processed product up to the instant it is discharged. The construction consists of an inverted "straw hat" bottom section with the rotor blades extending into the cavity at close tolerance with the wall and bottom. Processed material reaching the head section is mechanically propelled into the discharge pipe by centrifugal force and blade pressure, thereby simulating a "pumping action." This type of bottom head design is suited for effectively discharging highly viscous Newtonian type products.

The Dished Type of bottom head provides for discharge of bottoms product through an "off center" discharge connection. Simplicity in design makes it adaptable to the discharge of free-flowing products.

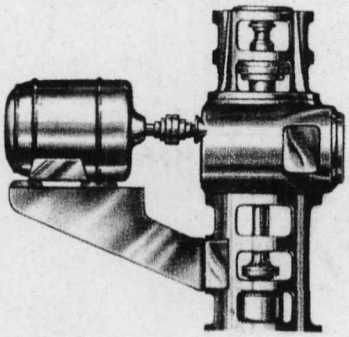
The Cone Type of bottom head provides for "straight-through" discharge of bottom product. For non-Newtonian type products having high apparent viscosity and poor flow characteristics, the cone bottom is well suited due to the ability in providing an extra large bottom opening for free flow to the discharge pump.



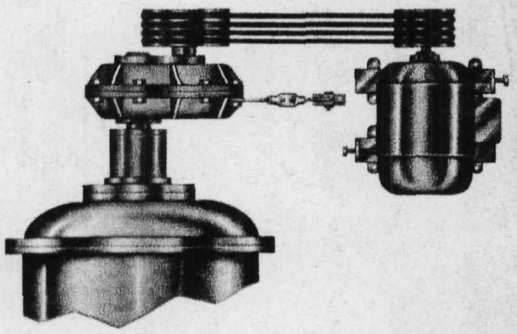
INVERTED POSITIVE DISCHARGE TYPE



elt and sheave—offers economy, ease in hanging rotor speed, ease in rotor re- oval for cleaning purposes. Processors p to 12" diameter fitted with belt and heave drives include brackets for inte- ral mounting of drive motor.



Inte-Drive®—Fixed-speed gear reducer type is integrally mounted on top of Processor. Eliminates need for separate mounting. Recommended for horsepowers of 40 hp and above for optimum bearing and seal life and rotor alignment.



Shaft mounted speed reducers—Combination belt and gear reducer. Offers ability of high speed reduction when necessary to operate at low rotor speed as with the Hydra-Film blade system.

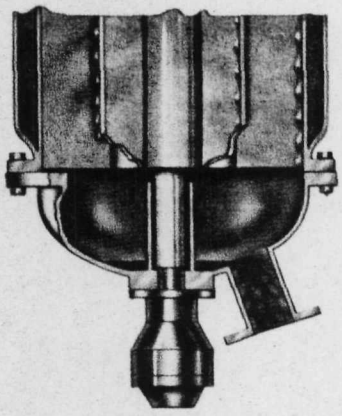
BEARINGS AND SEALS

All top bearings on Turba-Film Processors are external, radial type ball bearing for radial and thrust load. Single mechanical seals are furnished with option of double mechanical seals.

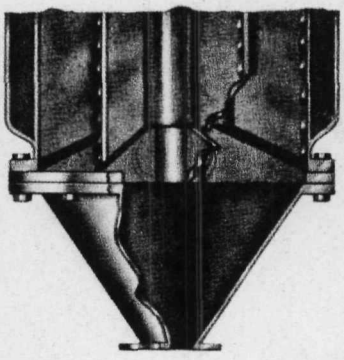
Bottom bearings and seals are of optional design depending on head design and process requirements. The cone bottom employs an internal bottom bearing fitted to a spider which maintains alignment of the rotor blade assembly. The bearing and housing may be made such that a lubricant, compatible to the process, will overflow out with the product, or an enclosed lubrication system can be provided.

Both the Inverted Positive Discharge head and the Dished Type bottom head can be provided with any one of the following bearing and seal arrangements, as determined by the needs of the product or process.

1. External radial type bearing with double mechanical seal.
2. External "well" type carbon bearing—no mechanical seal—fitted with either lubrication overflow or a closed lubrication system.
3. Internal carbon step type bearing—no mechanical seal—fitted with either lubrication overflow or a closed lubrication system.



DISHED TYPE

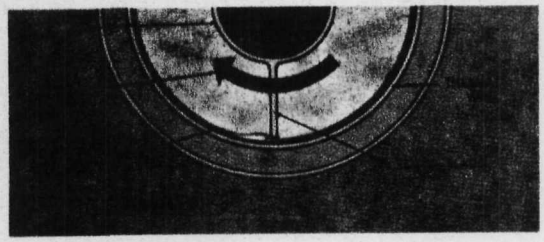


CONE TYPE

RODNEY HUNT

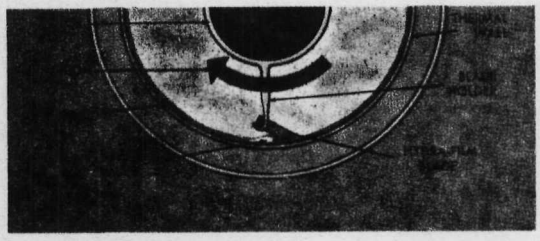
BLADE SYSTEMS

Product and process characteristics have dictated the need for more than one type of blade system to effectively reach the design requirements for various applications. Two types of blade systems are offered—the fixed clearance blade system and the Hydra-Film® blade system.



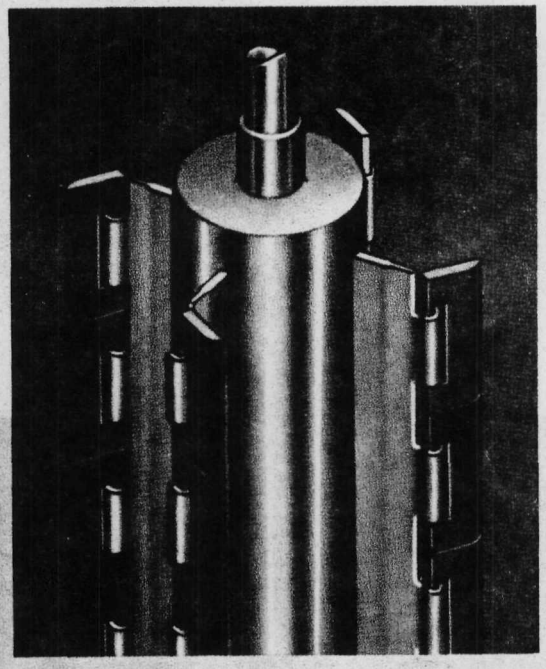
CLEARANCE BLADE SYSTEM

—utilizes fixed blades with pre-determined clearance at the thermal wall to provide a scrubbing action on the liquid film. Blade clearance is determined by the viscosity, surface tension, thermal conductivity and thruput rate of the material. A rolling fillet is formed on the leading edge of the blade with fillet size dependent on the physical properties of the material. The turbulent action and mixing imparted to the film and the turnover of exposed area on the fillet surface results in high heat and mass transfer. The liquid film on the wall continues downward in a spiralling manner subject to the turbulent action of the rotor blades.



HYDRA-FILM® BLADE SYSTEM

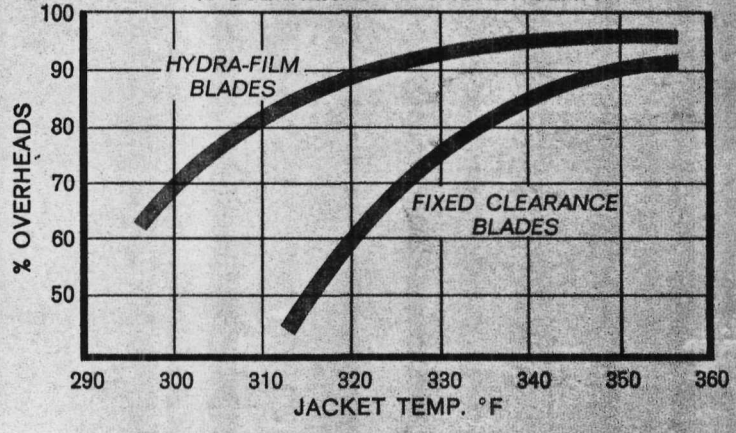
—consists basically of two types of hinged blades, used alone or in combination if necessary to the application. The planing type blades glide on the liquid film on the thermal wall to provide a wiping action. A slight lifting wave builds up in front of each blade, but this is not a fillet as in the case of the fixed clearance blade since the lifting wave is essentially independent of the thickness of the wall film. The plowing blade system uses a notched blade designed to accomplish a wall-scraping or film-plowing action particularly suited to ultra-high viscosity materials.



Both blade types operate at moderate tip speed and are swung outward by centrifugal force into contact with the liquid film. The combination of viscous drag, shear effect, and instant release of blade pressure results in thorough agitation and film mixing. By incorporating the principles of balanced hydro-dynamic design, the Hydra-Film blade system can effectively reach high boil-down ratios for those applications requiring a high per cent overheads. Reductions of 20 to 1 can be obtained, being equivalent to 95% evaporation. On products of certain characteristics, reductions of 50 to 1 or higher can be obtained continuously in a single pass.

Reduced power requirements, better product uniformity, and less heating surface area are some of the other advantages possible with the Hydra-Film blade system.

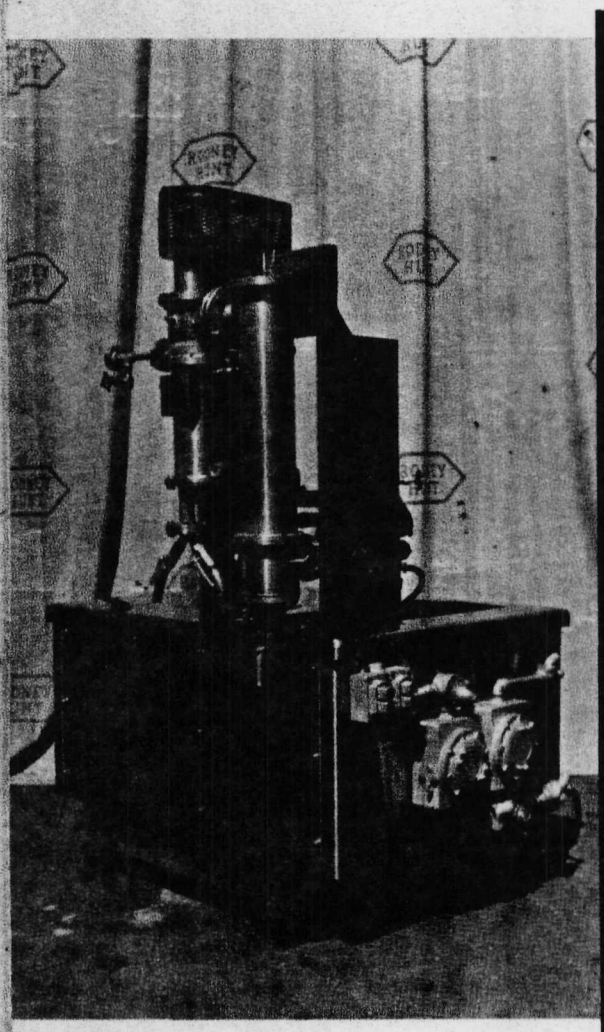
BLADE SYSTEM COMPARISON FOR TYPICAL ORGANIC DISTILLATES % OVERHEADS VS. JACKET TEMP.

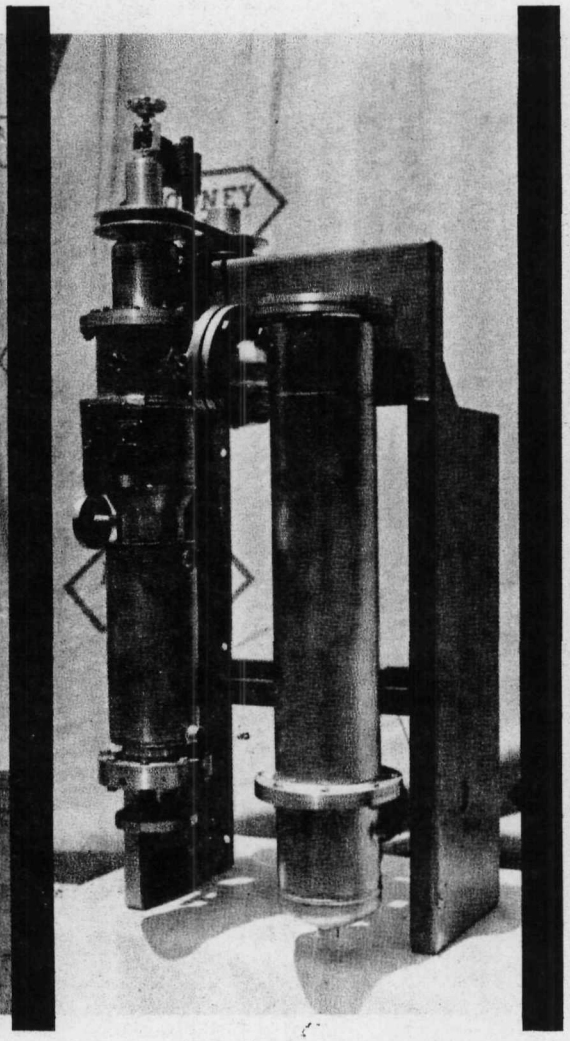


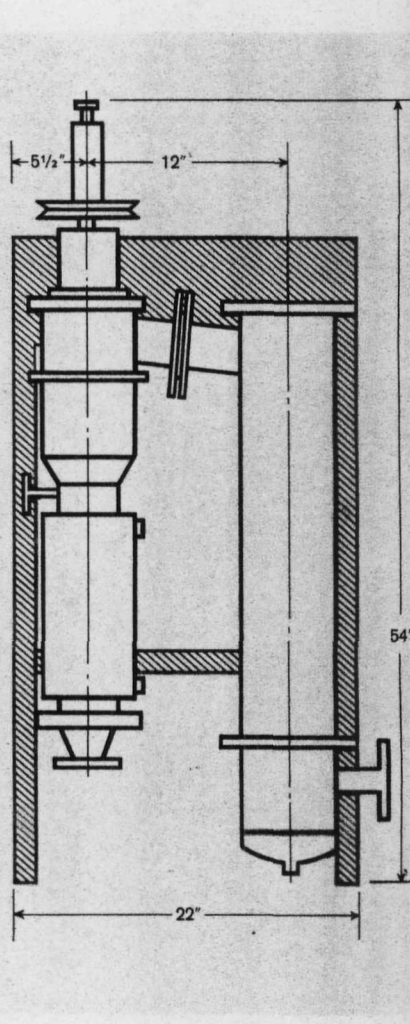
The graph at the right illustrates the typically greater overhead percentage obtainable for various steam jacket temperatures with the Hydra-Film blade system over fixed clearance blades. The data for the curves were taken at the same fixed feed flow and constant operating vacuum. For other feed rates and operating pressures, a family of curves can be plotted with different slopes, but continuing to show the comparative difference between the two blade systems. This performance curve for glycol recovery from tarry residues is typical for organic distillates.

LABORATORY UNITS

The ever-increasing number of new processes and products developed through research can usually be put into profitable commercial existence only after thorough piloting in small scale equipment. To meet this growing demand for experimental thin-film processing, Rodney Hunt offers laboratory model Turba-Film Processors suitable for scale up to commercially-sized equipment.







Two laboratory units are available. Illustrated above center is the one-square-foot Processor fitted with drive, surface condenser and support stand. Above left is the table model which incorporates the one-square-foot Processor with drive, surface condenser, support stand, vacuum-producing water jet, water circulating pump and stainless steel table with integral ice tank and push-button stations. The variable speed drive is fitted with a 1-hp explosion-proof motor. Feed pump, discharge pump, receiving flasks and instrumentation can be furnished as optional extras.

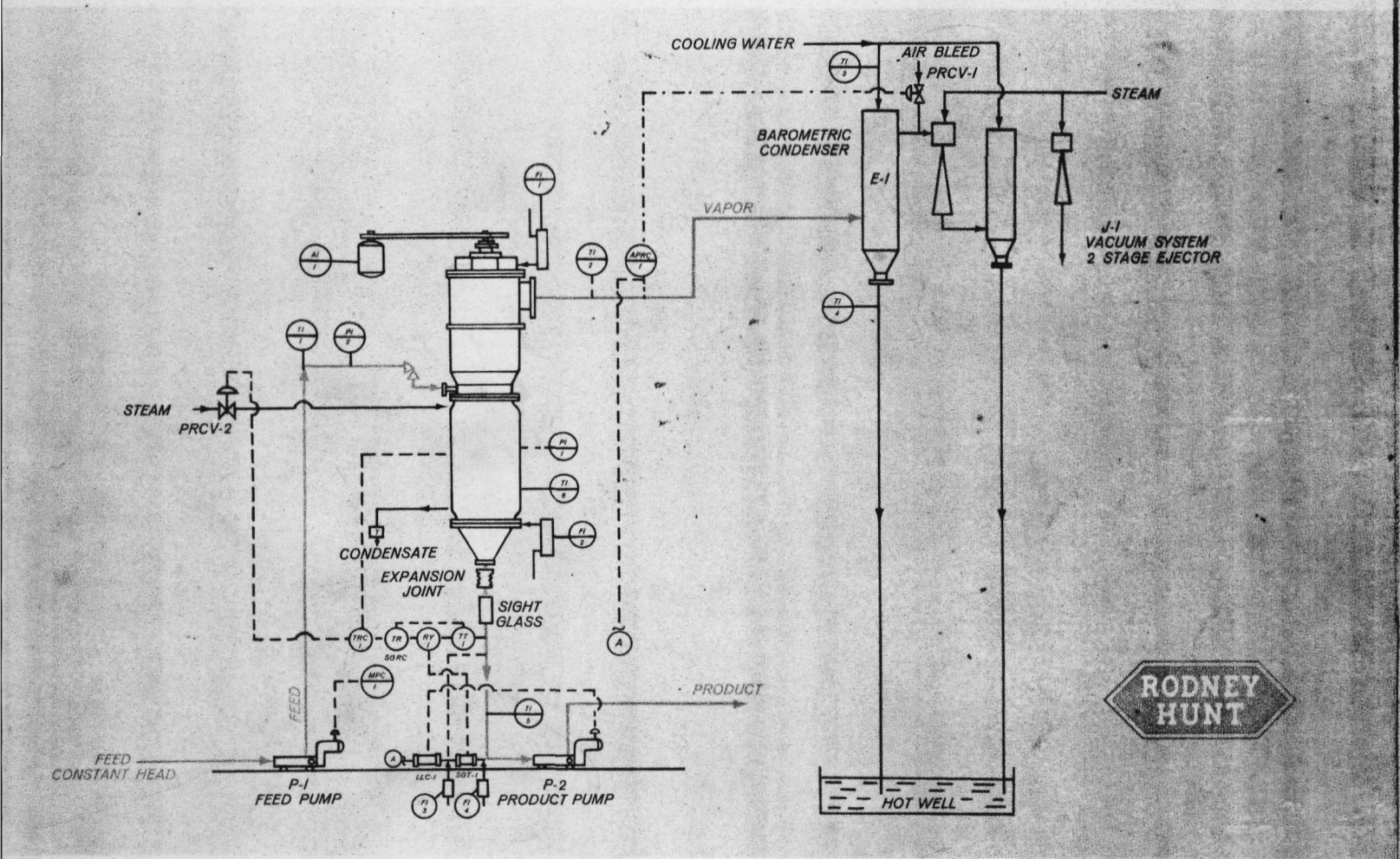
These units are also offered with design options including the Hydra-Film blade system, Inverted Positive Discharge Head, and compact concentric ring vapor separator.

Standard models in stock are fabricated from Type 316 stainless steel for 200 psig jacket steam pressure. Special units can be fabricated from nickel, Hastelloy, Inconel, Monel or other alloys as required to meet particular needs.

PACKAGE SYSTEM

Rodney Hunt offers you the services of its engineering organization to assist you in the design of your process and will supply a complete "equipment package". Their knowledge and experience provide the practical assistance which leads to the successful start-up of a complete Turba-Film Processor system including instrumentation, controls, pumps and auxiliary equipment.

The flow diagram below illustrates in general the auxiliaries and controls that may be furnished to make up a complete system. Plant needs and process requirements determine what actual controls and auxiliaries are required to insure proper operation and performance of the Turba-Film Processor.



PUMPS – To obtain a constant feed flow rate, a positive displacement type pump with variable speed drive is generally recommended. The product discharge pump is also usually of this type. The selection of either is based upon product characteristics and service requirements.

CONDENSERS – When condensing water vapor, a direct contact barometric condenser may be used. For recovery of vapor condensate as process water or in the condensing of solvents, a tubular surface condenser is provided.

VACUUM SYSTEMS – For removal of non-condensable gases and maintaining of vacuum, single or multiple stage steam jet ejectors can be furnished. Alternately, positive displacement vacuum pumps can be provided depending upon required vacuum, vapor characteristics and plant economics.

INSTRUMENTATION – Control of absolute pressure within the Processor and steam jacket temperature are basic to good Turba-Film performance. Additional instrumentation may be included to regulate product concentration, liquid level in the outlet pipe, and "fail safe" devices for steam and feed cutoff. An enclosed panel board can be provided to incorporate all control instrumentation, dial gauges, flow indicators and push-button stations.

MISCELLANEOUS – When necessary, the following auxiliary items may be furnished:

- Feed preheater
- Product cooler
- Thermal compressor for boosting vapor temperature
- Steam condensate exhauster
- Condenser tail pipe pump.

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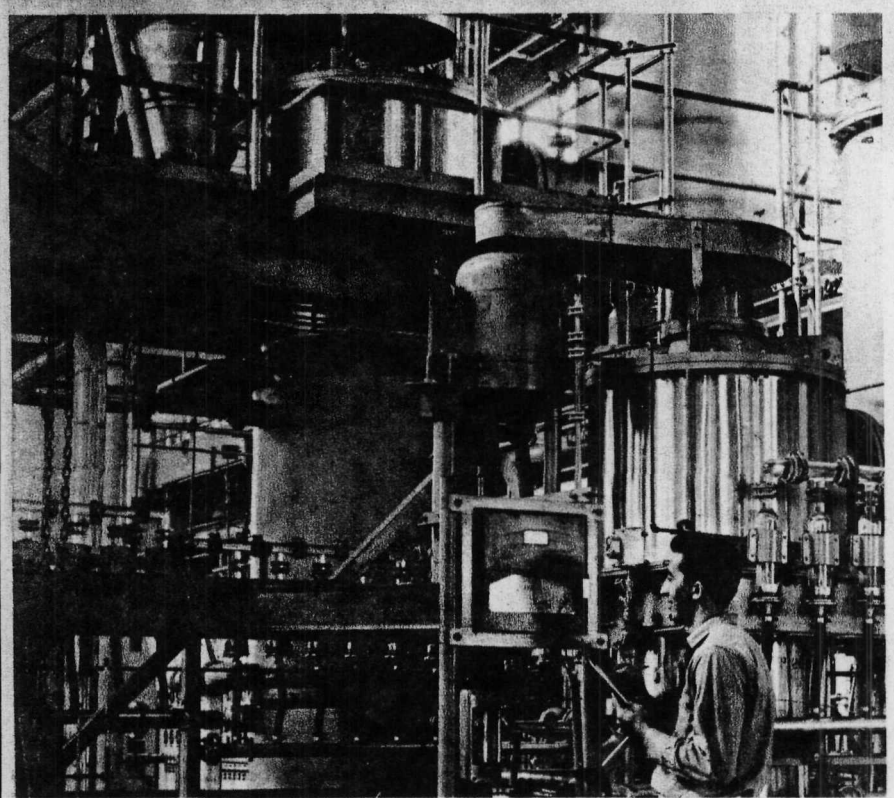
TURBA-FILM PROCESSORS

More than 375 Turba-Film Processors are currently in operation throughout the process industries — in chemicals, petroleum, food, pharmaceutical and many other areas — providing simplified solutions to difficult processing problems.

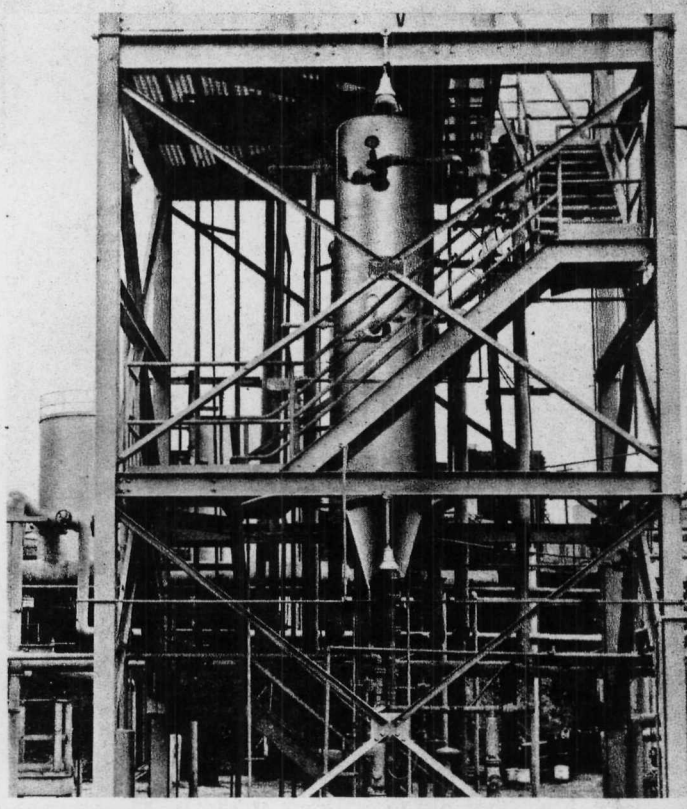
A few typical installations are illustrated on these pages. Among other well-known companies using the Turba-Film Processor are these:

Abbott Laboratories
Allied Chemical Corporation
The American Agricultural Chemical Company
American Cyanamid Company
American Home Products Corp.
American Viscose Division
The B. F. Goodrich Company
Celanese Corporation of America
Chas. Pfizer & Co., Inc.
The Coca-Cola Co.
Colgate-Palmolive Company
Continental Oil Company
The Dow Chemical Corp.
Eastman Chemical Products, Inc.
E. I. du Pont de Nemours & Co. (Inc.)
E. R. Squibb & Sons
The Firestone Tire & Rubber Company
General Aniline & Film Corporation
General Foods Corporation
The Goodyear Tire & Rubber Company
Hercules Powder Company
H. J. Heinz Company
Humble Oil & Refining Company
Jefferson Chemical Company, Inc.
Kraft Food Division
Monsanto Chemical Company



HOFFMANN-LaROCHE, INC.

Two of the half-dozen Turba-Film Processors at the Hoffmann-LaRoche plant in Nutley, New Jersey. The units are used for processing various time-at-temperature-sensitive pharmaceutical products.

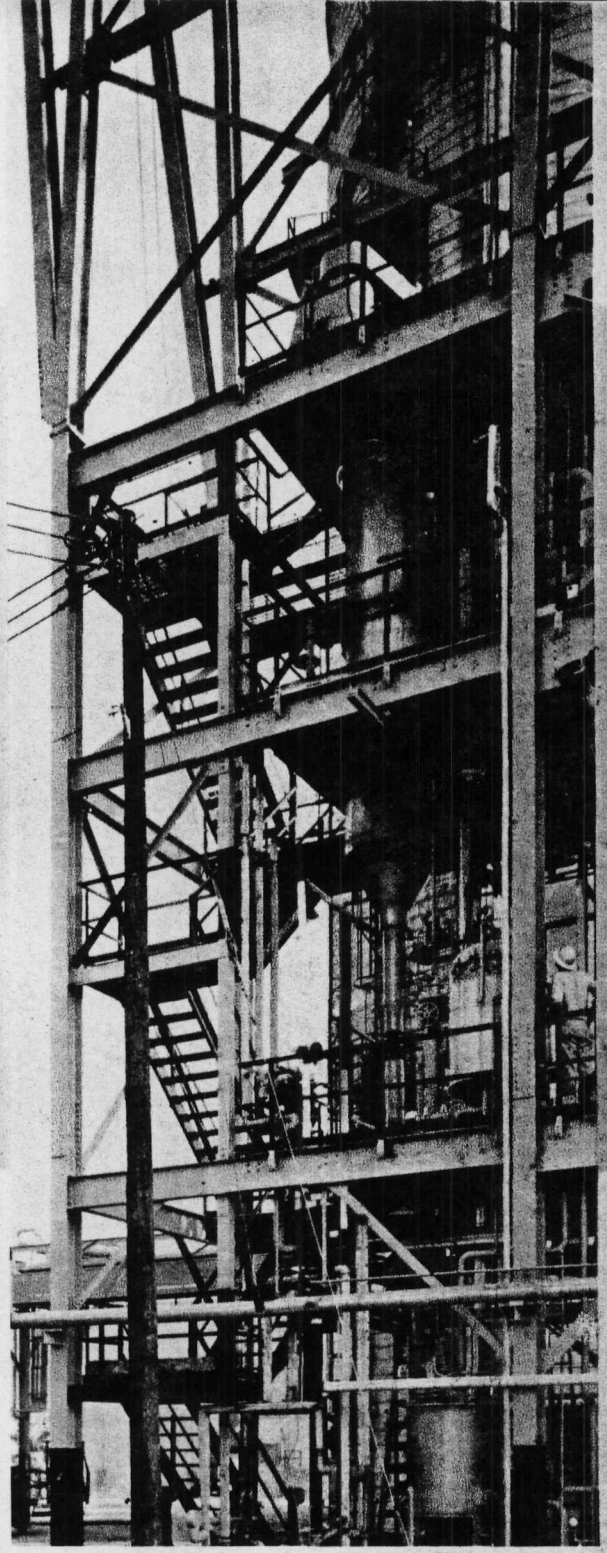


SHELL OIL COMPANY

A special petroleum product is dehydrated by this Processor at Shell Oil Company's refinery at Martinez, Cal. The acute scale formation problem that existed with conventional equipment was thus eliminated.

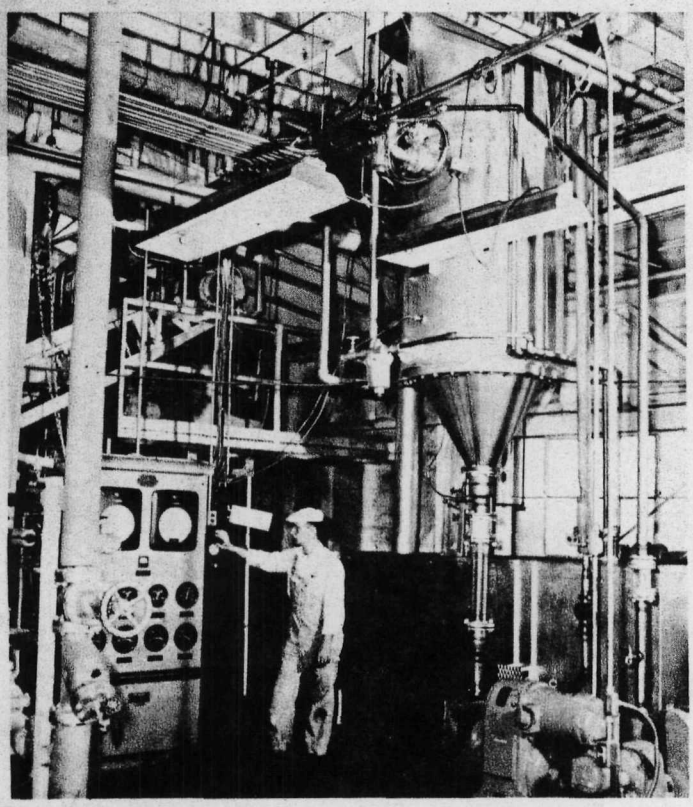
on stream

Nopco Chemical Company
Olin Mathieson Chemical Corporation
Pennsylvania Refining Co.
The Procter & Gamble Company
Schering Corporation
Shell Chemical Company
Standard Brands, Incorporated
Stauffer Chemical Company
Swift & Company
3M Company
United States Rubber Company
Union Carbide Corporation
W. R. Grace & Co.



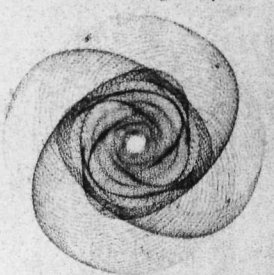
SOHIO CHEMICAL COMPANY

High-grade urea is produced at this plant of the Sohio Chemical Company. The Turba-Film Processor shown concentrates the urea so rapidly that formation of biuret is practically eliminated, even at the high operating temperatures.



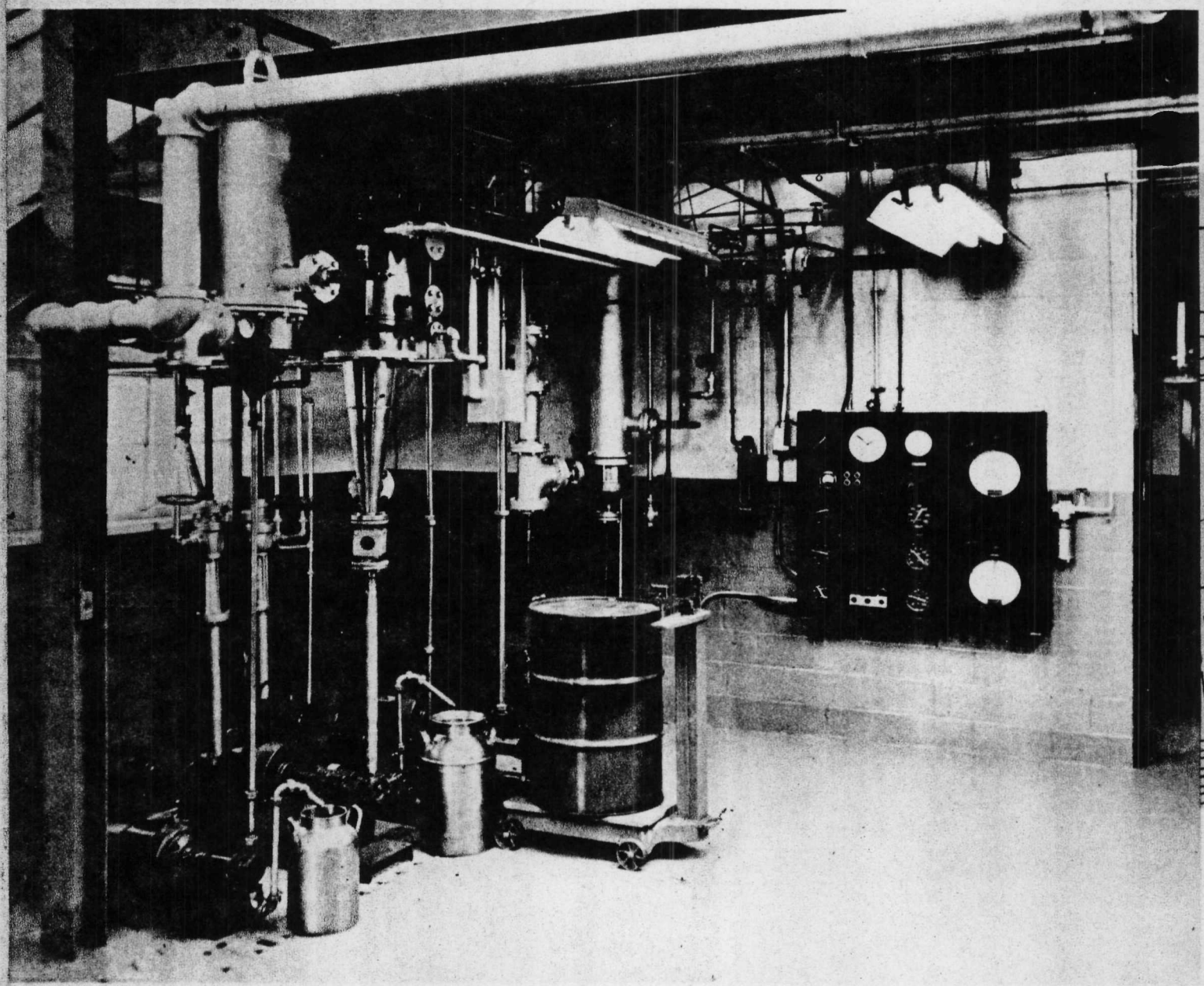
CALIFORNIA PACKING CORPORATION

At the San Leandro plant of the California Packing Corporation, this Turba-Film Processor operates 24 hours a day during the peak season producing Del Monte brand apricot, pear and tomato concentrates.



LABORATORY AND PILOT PLANT

To help you in your process or product development, Rodney Hunt maintains a well equipped laboratory and pilot plant in Orange, Massachusetts. This facility is staffed with engineers and technicians who are widely experienced in the application of Turba-Film Processors in food, pharmaceutical, plastics, petrochemicals and many other fields. Their knowledge is supported by extensive records of hundreds of product tests and evaluations which provide basic data to expedite new product testing. Here is where you can find answers to your problem.



RESEARCH & TESTING

Facilities include several one-sq.-ft. laboratory size units for steam or hot oil heating to permit tests at feed rates ranging from 5 lbs. per hour to 100 lbs. per hour and at operating pressures between <1.0 mm Hg absolute and pressures higher than atmospheric. Pilot plant sizes of 5.5 sq. ft. and 7.5 sq. ft. are available for larger scale work and semi-commercial production of materials for market testing and product evaluation.

For those applications where it is impossible or impractical to use the Rodney Hunt testing facilities, rental units are available for product testing on plant premises to permit extrapolation to production-size equipment.

Procedures for such testing are outlined in Procedure Bulletin No. 43, a copy of which will be sent on request.